

The formulae $\frac{\partial \rho U_i}{\partial t} + \frac{\partial}{\partial x_j} (\rho U_j U_i) = -\frac{\partial p}{\partial x_i} + \frac{\partial}{\partial x_j} \left(\mu \frac{\partial U_i}{\partial x_j} \right) + g_i (\rho - \rho_0)$ for building $\frac{\partial}{\partial x_j} (\rho U_j \bar{U}_i) = -\frac{\partial p}{\partial x_i} + \frac{\partial}{\partial x_j} \left(\mu \frac{\partial \bar{U}_i}{\partial x_j} - \rho \bar{u}_i \bar{u}_j \right) + g_i (\rho - \rho_0)$ state of the art $\frac{\partial}{\partial x_i} (\rho U_i \bar{H}) = \frac{\partial}{\partial x_i} \left(\lambda \frac{\partial \bar{H}}{\partial x_i} - \rho \bar{u}_i \bar{h} \right)$ biomedical research facilities.

DRM Appendix O.1: Insect Facilities

A new appendix, Appendix O Specialty Labs, has been added to the DRM. Currently there are two sections in the Appendix: O.1 Insect Facilities, which is new, and O.2 Electron Microscope Facilities which has been in previous editions. It is expected that additional Specialty Lab sections will be added to Appendix O as the need for them is identified and they subsequently written; future additions will be announced in News to Use articles.

Insect Facilities

Section O.1 Insect Facilities addresses the design of facilities where insects are housed, reared, and/or genetically modified. Most insects are not intrinsically dangerous, but they become a public health concern when they are infected and become vectors (carriers) of pathogens. Insects are vectors for malaria, West Nile Virus, Zika, dengue fever and other serious diseases. Insects of primary interest to biomedical researchers include mosquitoes, flies, and fleas, but in addition to insects, the principles outlined in Section O.1 can be applied to facilities designed for ticks, spiders, and other biting and stinging arthropods.

Insect facilities must be designed for the safe, secure, and efficient handling of pathogens as well as pathogen-infected insects, which adds complexity due to the insects' size, mobility, and unpredictable behavior. In addition to facility and insect-specific requirements, systems shall comply with all appropriate sections of the DRM.

Overview of Contents

Containment. Containment is required to prevent insects from either escaping from or entering the facility. This is especially important with populations that are infected, genetically modified, or invasive species.

Arthropod Containment Level (ACL). Insect facilities are classified by ACL, which is somewhat analogous to BSL levels for biocontainment labs. ACLs are determined by the risks and safety considerations related to working with particular pathogens.

Planning Considerations. Information gathering and developing a Basis of Design are essential for defining the requirements and functionality of the facility. Key information includes the species and varieties of insects, pathogens, procedures to be performed,

security and containment requirements, equipment to be used, environmental parameters, and all other factors that will have an impact on the facility design, maintenance, and operations.



Mosquito housing in an insect facility.

Environmental Requirements. The appropriate environmental conditions for insects, staff, and research must be determined and provided. HVAC systems must be designed for varied temperature and humidity as well as reliability, flexibility, testing, and certification.

Facility Design. The facility must be designed to safely and efficiently perform the established standard operating procedures and to address all required facility functions including security access, containment, flows (e.g. of people, material, and equipment), maintenance, cleaning, decontamination, waste management, and operation and support functions. Important aspects of facility design are:

- Architectural Design, including all-white finishes, low ceilings, minimized fixed casework
- Heating, Ventilation and Air Conditioning, including screens on all air devices and containment via airflow direction
- Plumbing, including screens on all devices and plumbing fixtures, design for disinfection
- Electrical, including sealed devices, boxes and conduits, diurnal lighting, access control

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. **Please address questions or comments to:** shawm@nih.gov

Further details on this month's topic are available on the DRM website DRM Appendix O.
<https://www.orf.od.nih.gov/PoliciesAndGuidelines/Pages/DesignRequirementsManual2016.aspx>